Review of Wetland Water Budgets for Aquila

Prepared by Mike Pennington on May 1, 2018

March 2018 Submittal

In March 2018, DEQ staff reviewed Aquila's response to the DEQ January 19, 2018 correction request. The response document entitled "Response to Michigan Department of Environmental Quality Comments dated January 19, 2018 on the Back Forty Project Wetland Permit Application" was prepared to respond do MDEQ concerns over the accuracy of groundwater drawdown model and wetland water budgets. DEQ staff (primarily Mike Pennington and Kristi Wilson) reviewed the water budgets and concluded that the water budgets were prepared incorrectly and they did not provide sufficient information to determine how construction of the project would affect the remaining wetlands and how many acres of impact there would be. The water budgets that were prepared greatly overestimated runoff into the site and underestimated infiltration rates. The water budgets used a runoff coefficient of .90 that was applied to total monthly rainfall. The formula assumed that 90% of the precipitation that fell on the watershed contributed to the wetland hydrology. Using this coefficient is not appropriate due to the types of soils (sandy) and vegetation that were present in the area. With regards to infiltration rates, the water budgets used a rate of .9 inches that was applied to each month. The notes associated with the water budgets state that this rate was determined from slug tests on site. The applicant did not provide results of slugs tests and it is highly unlikely that every wetland would have the same "tested" infiltration rate. In addition, the presence of sandy soils on site would result in a rate that was much higher. Lastly, the formulas they are using to determine infiltration using a constant are not appropriate. For example, in the winter the ground is frozen so there is no infiltration that occurs. However, in the summer months when the water table is likely below the soil surface much greater infiltration would occur. This is especially true in circumstances where the water level is drawn down. The use of a constant, low infiltration rate for each month does not accurately represent the infiltration that the wetland is likely to experience throughout the growing season.

March 21, 2018 Meeting with Aquila

Results of DEQ's review of the wetland water budgets were discussed at a meeting in Lansing on March 21, 2018. There were several discussions about the items listed above, the accuracy of the groundwater model and the conclusion of the amount of wetland impact under operating conditions. At that meeting Michael Pennington, DEQ's Wetland Mitigation Specialist, identified issues related to infiltration rates and watershed contribution and suggested the use of the Pierce 2013 model to predict water level fluctuations in the wetland. This is the model recommended by DEQ staff to design wetland mitigation projects. Michael Pennington provided two versions of the model to Aquila's consultants in a March 21, 2018 email to Jeff King. Included in that email were initial assumptions that were to be used for infiltration rates, watershed calculations (using TR-55) and natural weir heights based on monitoring well data. Aquila agreed to prepare modified water budgets for future discussion using these models.

March 27, 2018 Revised Water Budget for Wetland A-1

Jeff King submitted a revised wetland water budget on March 27, 2018 for review for wetland A1-A3. The intent of the submittal was to have DEQ review the model to gain approval prior to moving forward with revising other wetland water budgets. DEQ reviewed the model and determined that a new approach was fairly consistent with the Pierce Model. Runoff was greatly reduced using TR-55 method

of calculating runoff and infiltration rates were fairly consistent with a rate of -6.0 inches per month. Mike Pennington (DEQ) and Aquila's consultants discussed the model in a conference call the following day. Mike Pennington recommended modifying the model slightly to allow water table values to drop below the soil surface. This recommendation was to determine what affect the drawdown would have during operating conditions. Jeff and company agreed to make this modification and prepare the models for the remaining wetlands.

April 6, 2018 Submission of Revised Water Budgets for WL-40-41 and WL-C-1 Lobe

On April 6, 2018 Jeff King submitted revised water budgets for wetlands WL-40-41 and WL-C-1. Several changes were made to the model that were not discussed with DEQ. The biggest change was with respect to runoff contribution to the wetlands. Aquila's consultants abandoned the use of TR-55 and inserted a new method of calculating runoff using a runoff calculation in accordance with the USGS Oakes & Hamilton reference for the Menominee River watershed. Mike Pennington reviewed this change and thought it was not appropriate for use in a wetland water budget model. Runoff into wetlands should be determined by the watershed surrounding the wetland and not a stream runoff model. Using this method the runoff contribution to the wetland was greatly exaggerated. The method for calculating infiltration was also modified although values were similar to what DEQ suggested. The model was modified as requested to allow water levels to be shown below the soil surface.

April 11, 2018 Submittal of Water Budgets from Mike Pennington to Mike Nimmer

To help clarify what DEQ was asking for Mike Pennington prepared revised water budgets using the Pierce model for WL-40-41. The water budgets were prepared using TR-55 for surface water runoff, infiltration rates of approximately 6 inches per month and water table data from piezometer readings provided by Mike Nimmer. Water budgets were prepared for the wetland at the location of the piezometers as well as at the wetland fringe. The water budgets prepared by Mike Pennington showed that infiltration rates and presence/absence of groundwater were the driving factors affecting the level of water in the wetland when comparing existing and operating conditions. Mike also noted that the way the monitoring wells were installed was probably resulting in higher water table readings. Mike Pennington and Aquila's consultants (Jeff King, Don Tilton and Mike Nimmer) had a lengthy discussion on April 12, 2018 about surface water runoff and it was apparent that Aquila didn't agree that TR-55 was appropriate even with a low runoff curve number. They also didn't understand how groundwater levels affected infiltration rates in the model. Regardless, they agreed to run the rest of the models using the assumptions provided by Mike Pennington in accordance with this model. They also agreed to put existing and operating water levels on the same hydrograph to allow for easy visual comparison.

April 20, 2018 Submittal of Revised Water Budgets

On April 20, 2018 Jeff King submitted revised water budgets for all wetlands. Water budgets were to be submitted with assumptions used in Mike Pennington's previous submittal to Mike Nimmer. However, Aquila's consultants once again changed several factors/assumptions in the revised water budgets. Specifically, infiltration rates were reduced from 6 inches per month to 3 inches with no data to justify the reduction and the influence of groundwater on infiltration rate was completely removed from the model. As a result, all of the models that were prepared showed no change between existing and operating water levels with the exception of a small runoff event in November. On Monday, April 23 2018 Jeff emailed Mike Pennington with another justification for increasing infiltration rates based on a stream study of Pike River in Wisconsin. The reason for that submittal is unknown since it wasn't requested and wasn't part of the models previously provided on April 20, 2018. The new information was discussed in a follow-up conference call that afternoon with Jeff King, Don Tilton, Mike Nimmer and Kristi Wilson. Mike Pennington explained that the new information was not appropriate for inclusion in

a wetland water budget. There was lengthy discussion pertaining to all of the information that had been submitted to date. Kristi Wilson documented the call in a note to the file.

April 27, 2018 Submittal of Revised Water Budgets

On April 27, 2018 Jeff King submitted revised water budgets for wetlands 2b, 6, 40/41, A1East, A1West, B1 and C1 Lobe using assumptions requested by Mike Pennington in his April 11 email to Mike Nimmer. Specifically, the assumptions used were (1) no surface runoff contribution to the wetlands other than snowmelt and one November rain event of 2.5 inches, and (2) an infiltration rate of 6 inches per month. Based on the email from Jeff King, the outputs from the revised water budgets resulted in an increase in indirect impacts to wetlands from approximately 17 acres to approximately 31 acres. These estimates include the estimated loss of 6.15 acres of wetland at WL14/14a/15 (as suggested in the original permit application), an estimated loss of 12.48 acres (as compared to the 1.93 acres in the original permit application, so 10.55 acres more) in the western lobe of Wetland A1, and an estimated loss of 3.60 acres (as compared to the 0.10 acres in the original permit application, so 3.50 acres more) along with approximately 231 linear feet of intermittent stream in Wetland 6. Jeff also stated that in the email that they did not think that there were offsite impacts to wetlands. Mike Pennington reviewed the water budgets and agreed that they were generally prepared per DEQ recommendations and that they more accurately represent conditions in the field based on available data. However, no maps were provided that showed exactly where the increased indirect impacts were likely to occur. In addition, no justification was provided for why some wetlands had increased impacts and others did not and why the conclusion was reached that there would be no offsite wetland impacts.

General Conclusion with Regards to Wetland Water Budgets

DEQ staff have spent considerable time over the last month reviewing several versions of wetland water budgets prepared by Aquila's consultants. Although the April 27, 2018 submittal uses assumptions recommended by DEQ, this submittal fails to document the specific cause of the increased wetland impact and why it was determined that there would be no offsite impacts. There seems to be a general lack of understanding by Aquila's consultants on how wetland water budgets can be used to document the likely amount and extent of wetland impacts. On numerous occasions they have submitted revisions to water budgets that are inappropriate and use incorrect assumptions. They also have not incorporated on-site data (such as soils borings and piezometers) into water budgets which would increase their accuracy in determining impacts. In addition, WRD's water withdraw staff have reviewed the groundwater drawdown model and concluded that the model is not well calibrated and may underestimate the amount drawdown that is likely to occur under operating conditions of the mine. Since the groundwater drawdown model is used to prepare the wetland water budgets, an accurate, well calibrated drawdown model is necessary to determine the extent of wetland impacts caused by the project.